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*NATURAL HISTORY MUSEUMS (I).**

IN the prevailing scientific activity of the world the enduring vigor which we display in finding out all we can know about ourselves, this point in space we inhabit, what it contains, what it has contained, and what it may be made to contain, the Museum appears as perhaps the most significant emblem of our untiring industry.

If I may use my own language employed in another connection, the museums "appear like monoliths over a country which has become imbued with the scientific spirit, here raised to the memory of some local worker, there stately monuments of cosmopolitan learning, which in the centers of commercial activity preserve alive the genius and the zeal of original research. All are nurtured by the same love of the actual and its relations and laws, and all embody the incessant spirit of observation, comparison and knowledge.

"In the United States, favored by natural causes, the variety and wealth of our natural resources, by the adoption of scientific instruction in our schools, by the practical habits and cultivated instincts of observation of our people, the liberality of general and State governments in organizing surveys, and the helpful impulses of lyceums, lectures and societies, scientific museums increase rapidly."

* Read before the Gamma Chapter of the Phi Beta Kappa, April 26, 1898.

But when we consider the collecting instinct of man, something primordially allied to the gathering habits of a squirrel or a pack-rat, the chromatic eccentricity of an oriole or a bower-bird, or the vandalism of a shrike or a racoon, we may anticipate that, unregulated, it can produce the most fantastic and inane combinations of objects. And it does. The comment of a German writer, Wilhelm Bürger, on the misleading collections of the art museums of his own country should be profitably quoted. He says: "Our museums are the veritable graveyards of art, in which have been heaped up, with a tumulous-like promiscuousness, the remains of which have been carried thither. A Venus is placed side by side with a Madonna, a satyr next to a saint. Luther is in close proximity to a Pope, a painting of a lady's chamber next to that of a church. Pieces executed for churches, palaces, city halls, for a particular edifice, to teach some moral or historic truth, designed for some especial light, for some well studied surrounding, all are hung pellmell upon the walls of some non committal gallery—a kind of posthumous asylum, where a people no longer capable of producing works of art come to admire this magnificent gallery of débris."

But these mere failures of perception, these obvious incongruities of place, time and concept, are less detestable certainly than the ceaseless association of things which have no conceivable relations. To use a word thrown now into organized speech by the peculiarities of certain literary productions of our day, there is a latent 'yellowness' in men which can be insidiously evoked to some sort of response, and there is a phase of attention which emits, as it were, a reflected gleam of puerile pleasure, when a museum cabinet summons its notice to the skull of a murderer at rest along side of a brick from the Great Wall of China, the tooth of a shark inoffensively placed in juxtaposition with the thighbone of the diver whose fate it determined, or the jaw of a gorilla by the side of William Tell's arrow, if not a wax model of the original pippin it so luckily transfixed.

These are not purely aggravatedly imagined cases, devised for your amusement. The provincial museums of England, for instance, were long a scandal. Poorly supported, absurdly arranged, without discriminating curators, they became mixtures of oddities, monstrosities and perversions. Listen to this well-informed and well-weighed recital from the lips of W. Boyd Dawkins: "In one instance which occurs to me you see a huge plaster cast of a heathen divinity surrounded by fossils, stuffed crocodiles, minerals and models of various articles, such as Chinese junks. In another a museum unit takes the form of a glass case containing a fragment of human skull and a piece of oatcake labeled 'fragment of human skull very much like a piece of oatcake.' In a third wax models are exhibited of a pound weight of veal, pork and mutton-chops, cod-fish, turnips, potatoes, carrots and parsnips, which must have cost the value of the originals many times over, with labels explaining their chemical constitution, and how much flesh and fat they will make. * * * * In very many museums art is not separated from natural history, nor from ethnology, and the eye of the beholder takes in at a glance the picture of a local worthy, a big fossil, a few cups and saucers, a piece of cloth from the South Seas, a war club or two, and very possibly a mummy." As an American analogue some of us may recall the Athenæum in Nantucket town with its museum of mingled odds and ends, models, whale jaws, implements, antiquities and dirt, though there our literary intuitions appreciate its extreme availability for the pen of Miss Wilkins or Sarah Orne Jewett.

But this state of affairs has sensibly vanished. Except in those horrifying aggregates of things in heaven, and on the earth, and in the waters under the earth, to which a commercial spirit has promptly affixed the name of dime museums, such disordered collections are only met with in juvenile clubs and country lyceums, where the bucolic appetite feeds rejoicingly on wonders. To-day enlightenment growing with each rising and setting sun, curiosity whetted by the unfailing experience and reading of every hour, delight animated by renewed accessions of pleasure at each new object of interest, each new principle of nature, each new sign of scientific conquest of the world —all these, enlightenment, curiosity, delight, demand that the Museum shall become a teacher, an expounder, a camera. They demand from it speech and learning and illustration, philosophy and order and a deepened willingness to lead the daily run of men and women into avenues of beauty, into avenues of knowledge, into avenues of stimulating suggestion. They ask that it be a *conspectus* of things, such as embodies the *consensus* of modern scholarship.

To the great multitude which from circumstances of life, from neglect, from penury, from the hard fulfillment of material tasks, from lethargy, from congenital deficiency, or from whatever other cause in the wide prospect of contingency which besets us all, have not received the gift of education—to this multitude the great Museum comes with some sort of recompense for its denial. Great indeed! above college or university or pulpit or cathedral if from the mind of that multitude, thankful and patient, it dispells darkness and by the mere spectacle of art or nature or science, in its luminous thought-giving halls, pours upon them the light of recognition and of knowledge.

Yet the functions of a museum are far from exhausted when it has expended all its available power to instruct and cultivate the people. It must minister to the needs of the investigator, stimulate his efforts and publish his results. The Smithsonian Institution of Washington, so far as it held for years undeveloped and poorly materialized the germ of the present National Museum, began its most beneficent career as an instrumentality of research. Its beneficial relations to the public as a curator of collections which it arranges, labels and displays appeared long subsequent to its office as a means of scientific investigation. In fact, in the new idea assuming more large and ambitious proportions each day, the museum in its wide relation to the world around it embodies the character of the collector, expositor or lecturer and the original investigator.

In character museums can be as various as the diverse fields of interest society or nature present. Art museums, in a modern sense, began with that of Cosmo de Medici in Florence, at the beginning of the sixteenth century, the Museum of the Uffizi. These rapidly multiplied and with their multiplication underwent specific differentiation. Museums arose devoted to the work of one man, as the Thorwaldsen Museum in Copenhagen, the Wiertz Museum at Brussels, the Donatello and Michel Angelo Museums in Florence. Museums of art became cabinets of curiosities, rarities, gems, handicraft, as the Cluny Museum in Paris, the Green Vaults at Dresden, the collection in the Tower of London, the Museum of the Hohenzollerns in Berlin, and that of the city of Paris, of all of which Dr. Goode says: "Such collections cannot be created. They grow in obedience to the action of natural law, just as a tree or a sponge may grow." Historical museums attach themselves naturally to the foregoing, and of these the list is long and intricate. Groups represent the histories of cities or provinces, as that of the Mark of

Brandenburg in Berlin, those of Paris, Antwerp, Brussels, local museums of antiquities, devoted to a country or race, or era, as the Etruscan Museums at Florence and Bologna, the Cairo, the Constantinople and Athens museums; and yet others perpetuate the lives and achievements of great men, as the Dante Museum in Florence, the Goethe Museum in Weimar, the Beethoven Museum in Bonn, while picture galleries devoted to the works of artists, the ramifications of dynasty or family, the miscellanies and relics of governors, generals, statesmen, enmeshed within the historical associations of one period, form still other classes, as the collection in Old South Church, Boston, the Kunst historisches Museum in Vienna, illustrating the history of the Hapsburg, and the Musée Historique de Versailles.

The museum of science is that form of the museum which now engrossingly attracts notice, because this is the moment of its highest development, and because science, ceaselessly advancing with all the abetting impulses of exploration at its command, is penetrating everywhere, and before the solvent powers of its touch and its genius the world, the universe and even the life of man fall into orderly and necessary arrays of evolutionary stages. Science is the enduring sensation of our day. The scientific museum embodies, when perfectly realized, when meeting its ideal requirements, the incarnation of the scientific mind, that mind, at its best, inexorably calm and of almost incalculable vision.

The Scientific Museum, if I may venture an epigram, is the expression of the Aristotelian mind. To the Stagyrite, in his classifying instinct, his analytical sagacity, so prophetic of the modern spirit, the Museum was doubtless a distinct idea. It would seem, conscious as we are of the vivid insight of the Aristotelian brain and its wise reliance on accumulation and comparison, that we might fix the rise of the scientific museum concept in his time, in his thought. It was, indeed, the triumphs of Alexander that awakened a profound movement of questioning in the culture of Athens. The new worlds, abounding in strange unheard of, unimagined phenomena, with their breadth of climate, novelty of scenery, peculiarities of race, plants and animals, which Alexander revealed, startled the innovating fancy of Greece with peculiar interest. Humboldt, in his colossal grasp of all the aspects of our planet, has written of these events: "The extension of the sphere of new ideas was owing to the magnitude of the space made known, and to the variety of climates manifested, from Cyropolis on the Jaxartes (in the latitude of Tiflis and Rome), to the eastern delta of the Indus at Tira, under the Tropic of Cancer. To these we may further add the wonderful diversity in the configuration of the country, which alternated in luxurious and fruitful districts, in arid plains and snow-crowned mountain ranges, the novelty and gigantic size of animal and vegetable forms, the aspect and geographical distribution of races of men of various color. * * * In no age, excepting only the epoch of the discovery and opening of tropical America, eighteen centuries and a-half later, has there been revealed, at one time and to one race, a richer field of new views of nature or a greater mass of materials for laying the foundation of a physical knowledge of the earth and of comparative ethnological science." Again, this sublime philosopher designates some scientific results of Alexander's conquests in these words: "Besides the knowledge of products which soon became objects of universal commerce and many of which were transported by the Seleucidæ to Arabia, the aspect of a richly embellished tropical nature speedily yielded the Greeks enjoyments of another

kind. The gigantic forms of hitherto unknown animals and plants filled their imagination with the most exciting images. Writers, whose dry scientific style is usually devoid of all animation, became poetic when they described the characteristics of animals, as, for instance, elephants, or when they spoke of the height of trees whose summits connot be reached by the arrow in its flight and whose leaves are larger than the shields of the infantry; of 'the bamboo, a light feathery tree-like grass,' 'each of whose jointed parts (internodia) may serve for a many-oared keel;' or of the Indian fig-tree that takes root by its branches and whose stem has a diameter of twenty-eight feet, and which, as Onesicritus remarked, with much truth to nature, forms 'a leafy canopy similar to a tent, supported by numerous pillars.'"

Those splendid accessions to the knowledge of Greek students, with their probable accompaniments of collections, might naturally have developed the museum idea in Alexander's friend Aristotle, the immortal type of the spirit of research. Professor Flower has alluded to the probable beginnings of museum collections in the "preservation of remarkable specimens, sometimes associated with superstitious veneration, sometimes with strange legendary stories, in the buildings devoted to religious worship. The skin of the gorillas brought by the navigator Hanno from the West Coast of Africa, and hung up in the temple at Carthage, affords a well-known instance."

When learning revived; when, to use the exquisite language of Pater, "the desire for a more liberal and comely way of conceiving life, make themselves felt, prompting those who experience this desire to seek first one and then another means of intellectual or imaginative enjoyment, and directing them not merely to the discovery of old and forgotten sources of this enjoyment, but to divine new sources of it, new experiences, new subjects of poetry, new forms of art"—then sprang up, too, with the new evidences of mental regeneration the desire of keeping together beautiful and curious things.

Naturally, the first developments were in the nature of collections of art, the bringing together in groups sculpture and paintings and antiquities. Since the revival of learning began with the passionate devotion to classical literature the rich and learned turned with an appropriate ardor to all that could be obtained in that buried field of emotion, grace and eloquence. And since the art of the pagan, as Taine urges, brought the revivifying breath that made Christian art beautiful and manifold, creative and cosmopolitan, so the ancient things of Greece and Rome were enviously gathered. Books and libraries and statues in museums were rapidly accumulated. It was a liberal prince, a rich merchant, a trading monarch, a distinguished physician, or the egotism as well as the enlightenment of a noble, that started the first growth of museums. Stones, gems, shells, fish and animals quickly assumed places in museum collections, and the long hidden instinct of natural study hastened hither and thither on land and sea the zealous and wondering collectors. Once started, the flame of desire spread quickly, and, everywhere fed by the oil of rivalry, men and women in high or in influential stations collected and collected and collected, turning their homes into storehouses of curiosities and maddening arrays of impossible associations. This very incongruity stimulated further efforts at an extravagant amplitude of contents and only as time passed on was a separation effected by which the provinces of Natural History and Art proper secured mutual independence. We can clearly realize the effectual assertion of temperament in such collections; how one man or woman with an inborn and now indulged love of nature col-

lected the objects of nature alone, and another the beautiful or industrial products of man. So drawing apart by a mutual repulsion the Museums of Natural History became separated from those of Art, and the fantastic combinations of a statue sprouting from a galaxy of shells or paintings alternating with fish skeletons and minerals or a bronze medallion encircled with bird's feathers happily disappeared.

The earliest museums were all private affairs prepared with some relevancy to the owner's tastes or the prevailing fashion of collectors. It was much later that clusters of individuals organized as societies made the building up of a Museum a part of their duty. Samuel Quickelberg, of Amsterdam, a physician, published at Munich in 1565 one of the first printed catalogues of such a museum; also at the same time Conrad Gesner described the cabinet of Johann Kentmann, a physician of Torgau, in Saxony, which consisted of 'minerals, shells and marine animals.'

Amongst the whimsicalities connected with this subject, the following extract from Professor Flower's address before the British Association for the Advancement of Science in 1889 fully reveals their amusing character. Professor Flower has brought to light an entertaining specimen page of a catalogue compiled by the two Tradescants, father and son, in 1656 and entitled 'Museum Tradescantium; or a Collection of Rarities preserved at South Lambert neer London;' item, 'Some Kindes of Birds their Egges, Beaks, Feathers, Clawes and Spurres; Divers sorts of Egges from Turkie, one given for a Dragon's Egge; Easter Egges of the Patriarch of Jerusalem; Two Feathers of the Phoenix Tayle; The Claw of the bird Rock, who, as Authors report, is able to trusse an Elephant; Dodar from the Island Mauritius; it is not able to fly being so big;' Again 'Garments, Vestures, Habits, and Ornaments,' again 'Mechanick, Artificial Workes in Carvings, Turnings, Sowings, and Paintings,' wherein we find the 'Pohatan, King of Virginia's habit, all embroidered with shells or Roanoke,' and the 'Cherry-stone upon one side S. George and the Dragon perfectly cut, and on the other side 88 Emperours' faces,' and yet another 'cherry-stone, holding ten dozen tortoise-shell combs made by Edward Gibbons.'

To-day the Museum of Science stands or ought to stand as the representative expression of the progress of science. Its possible dimensions are difficult to overestimate, for its proportions should be correlated with, and reflective of, all that learning thinks and nature shows in the vast provinces of creation. It is, I think, with supreme justice that Professor Flower boldly asserts that "it has only been the difficulties, real or imaginary, in illustrating them which have excluded such subjects as astronomy, physics, chemistry and physiology from occupying departments in our National Natural History Museum; while allowing the introduction of their sister sciences, mineralogy, geology, botany and zoology."

But it can also be profitably remembered that the maintenance of any stupendous accumulation of material, and its associated activities in lectures, publications and keepers involves gigantic expenditures not to be always well distributed or wisely administered. Therefore for very practical reasons the experimental sciences are not represented in our museums, withdrawing by a natural refinement of sympathy to schools of science, colleges, and special institutes, and the museum of natural history more distinctively presents to the public the manifestations of life, even of mind, and the inorganic elements and their combinations.

I have said that the museum exercises three functions, that of the collector, the

lecturer or expounder and the investigator. These three present the rounded outline of its attitude to the visitor, the pupil and the scientist. Let us examine these aspects of its nature and economy.

THE MUSEUM AS A COLLECTOR.

The museum furnishes the most substantial guarantee against the loss or scattering of valuable specimens. It naturally induces the deposit of private collections. It becomes in a short time the refuge of all sorts of cabinets, and, from the mutations of circumstances in private fortunes, it stands in the field as a desirable purchaser of private treasures. So initially in the ordinary development of the museum the collections come first. The British Museum, which now stands preëminent as the most complete embodiment of the museum idea, began its career with such a nucleus in the Cottonian manuscripts, coins, medals and antiquities, the Arundel and Harleian manuscripts, and the Sloane collection of natural history, antiquities and books. The National Museum of the United States, which developed within the franchises and purposes of the Smithsonian Institution, came into material objectivity with the collections, mostly minerals, of Smithson himself, to which ensuing years brought large additions from the Pacific Exploring Expedition, Perry's Expedition to Japan, the Pacific Railroad Survey, the Mexican Boundary Survey, the Surveys of the Army Engineer Corps and the Centennial Exhibition of 1876.

The Field Museum of Chicago sprang into sudden prominence from its huge heritage or acquisition of the dismembered sections and débris of the Chicago Fair, and our own American Museum of Natural History virtually was born when it was welcomed to Central Park by Commissioner Green, and deposited its collections in the old arsenal at 64th Street and Fifth Avenue in 1869. Those walls, which had reverberated to the martial grounding of arms in 1863, when riot held the throat of New York in its bloody fist, then witnessed a more peaceful invasion of birds and beasts, a silent procession, from whose mute forms, as named and classified, flow the tranquillizing influences of study.

The museum should also profitably invite to itself the numerous men who have, by accident or exploration, come into possession of beautiful or instructive objects. It centralizes the divergent impulses of discovery and brings into substantial importance the trader and dealer in natural productions. It is a sea of reception into which pour from all levels of observation the specimens which illustrate faunas and and floras and natural resources, mineral wonders and curiosities. The purchase of new objects, indeed the admission of new material, must be guided by the best professional advice, professional advice also that is known to be regulated by disinterested motives. No material should be secured which simply duplicates matter already on exhibition for the meretricious reason of its *slightly* greater elegance or splendor. Fundamentally museums as collectors are to instruct, though the æsthetic sense, of course, need not, on that account, be blunted or suppressed. Indeed, it is true that the most perfect things in nature are often the most instructive, and, at any rate, exhibits should challenge attention by their average superficial beauty. So much is to be bought and so much expended in all directions that money is wasted by buying what is already in evidence.

The line of development in a natural history museum cannot always be evenly maintained in all departments. When Zoology, Geology, Mineralogy, Ethnology and Botany are located under the same roof with interests enthusiastically defended by as many groups of curators there is inevi-

table collision, and the provident direction of all is a task demanding a wise sense of discrimination and responsibility, as well as a rather judicial indifference to special pleading and selfish aggrandizement.

But while the collection of specimens can be regulated by ordinary experience and skill, the exhibition of specimens demands an order of analytical sagacity and sympathetic insight not ordinarily possessed. Dr. Goode, in his famous epigram, declared that a museum was a collection of labels illustrated by specimens. This is not to be interpreted that a museum is to become a hall of signs. But it does mean that there shall be nothing left to surmise or guesses, but everything shall be named, and a further extension of its meaning implies that the combination of labels and objects shall be educational. The function of the museum as a collector encloses its function of so selecting and arranging objects as to educate. The selection of such objects as present a development or illustrate conditions, stages of growth, environment, supplementary associations, climate, position, form a visual lesson, become encyclopædic, and leave a deposit of impressions which express the science of the subject.

Let us take two concrete examples: A collection of shells can be minutely labelled and laboriously displayed, but how little does a scientific label, with the name of a genus and a species, tell the ordinary visitor! It supplies only an additional means of mental confusion. But let a group of shells be represented by a few well-selected and graded specimens showing stages of growth; let a general label explain their general characters, affinities and possibly uses; let a map show in colored areas their distribution, while a few prints, photographs or drawings represent the regions in which the shell lives, the appearance of the animal alive, with a possible dissection, and without going further the whole section becomes vitalized, and a living impression, measurably perfect and permanent, has been produced. Such a method of exhibition evokes the nascent properties of the young naturalist, while it holds the agreeable attention of the plainest visitor. James Whittaker, of Oldham, was 'a hand' in a cotton mill, who from hearing some one say, as he picked up a piece of coal shale, that there was a fish scale in it, was led to collect coal plants and reduce them to thin films by rubbing them down on the kitchen floor so as to reveal their minute structure. And this man's collection afterwards was used by Professor W. C. Williamson in his memoirs on coal plants published by the Royal Society. This story illustrates the supreme consequences of a suggestion. How wonderfully suggestive and stimulating may a museum collection become to congenial minds! Of course, in the case of Whittaker, as of Edwards, his Scotch analogue, the inborn tendency might have spontaneously, sooner or later, pushed their minds into such lines of study and research, but the dormant flame would have been in all cases more quickly kindled in the presence of a thoughtfully arranged exhibit. Such exhibits are mute pedagogics.

Again, a collection of minerals fails to express the ideas and lessons of mineralogy if it is a formally arranged succession of ticketed and labelled specimens. Mineralogy admits of a many-sided installation. It would be advantageous to display minerals in reference to their history, their crystallization and physical properties, their distribution and their specific multiplicity and characters. Usually the latter method alone is used, and then it frequently takes the form of a succession of specimens rather niggardly labelled. Primarily, it would seem that the object of a collection is to lay open the scientific aspects of the subject with some suggestions, introduced wisely

and with a proper sense of restraint, of the elaborations of the science.

Mineralogy offers a field of attractive experiment and has in some museums reached stages of taxonomic complexity. The history of minerals might very properly form the introductory stage with examples of ancient nomenclature: that followed by Theophrastus, Aristotle, Dioscorides and Pliny; then the later and mediæval period with reference to the lucubrations of Marbodius, Albertus Magnus and Agricola; and then the crystallographic systemic period of Jamitzer, Steno, Bergman, Rome de Lisle, Haüy, Bernhardi, Weiss, Mohs, Newman, Whewell, Miller. Following this as a logical pendent would come an exhibit of crystals with an anatomical analysis of their parts, somewhat as Professor Crosby has devised in the Museum of the Boston Society of Natural History. The physical properties, color, lustre, hardness, refraction, fluorescence, fusibility of minerals and illustrations of optical principles would be incorporated in this section. Finally, their distribution, which, under lithological and and economic supervision, would show the occurrence of the silicates, crystalline schists, marbles, limestones, clastics, eruptives, and the zones and centers of deposit of the useful or valuable ores, all illuminated by diagrams, maps and photographs. Then would follow the mineral cabinet, a display of expressive and beautiful specimens, subordinated to a chemical system, in which the design so well illustrated by Professor Egleston, in the cabinet of the School of Mines, of showing the varieties of a mineral, often so extreme and perplexing, would receive complete vindication. It seems impossible that a conspectus of minerals, arranged upon so wide and exhaustive and illuminative a plan, would not leave the attentive mind notably strengthened and informed. Similarly, in the various departments of zoology the most attractive and intelligent development of visual instruction could be followed with most fascinating and novel results. In geology, of which it has been lately remarked by Professor A. Geikie with relation to the extraordinary vitality of that science in the United States that "surveys, professorships, museums, societies, journals in almost every State are the outward embodiment of the geological zeal that appears to animate the whole community;" in geology the scheme of historical development might also be partially followed, while an elaboration in diagrams, photographs and discriptions of the morphology and significance of the groups of fossils should take precedence of an endless display of species. In large and capacious halls the systematic and the explanatory methods might both be utilized and combined. And, finally, in this connection, there seems a fascinating propriety in making a museum also a gallery of biography; the faces and some short sketch of their lives of the great investigators and systematists would seem appropriately placed amidst the teeming results and facts their genius and industry have produced and discovered.

The mechanical details of exhibition require all the charm, convenience, and even beauty, which the resources of the institution permit, and especially, should all architectural construction bend subserviently to the underlying necessity in every museum, the best illumination. Light, bathing everything with luminous clearness, is the very symbol of the museum purpose.

L. P. GRATACAP.
AMERICAN MUSEUM OF NATURAL HISTORY.

(*To be Concluded.*)

ANTHROPOLOGICAL EXHIBIT OF THE U. S. NATIONAL MUSEUM AT THE OMAHA EXPOSITION.

THE frequency with which the National Museum has been called upon to prepare

exposition exhibits has made it somewhat difficult always to secure fresh and interesting material for display. To obviate this difficulty in the Anthropological Department, it was decided to assemble the limited group of exhibits required, on a plan differing essentially from that adopted at previous expositions.

Heretofore the materials have been brought together in a somewhat disconnected way to illustrate particular peoples, or especial arts or industries. On the present occasion the activities of man are treated from the point of view of their development. The various lines of progress are represented by series of objects each individual typifying a step in the industrial and intellectual evolution of the race.

As the exhibits required had to be drawn from all divisions of the Department, a single series of objects in many cases being made up from the collections of two or more divisions or sections, members of the anthropological staff were called upon to act as committees in assembling the exhibits in which they were personally concerned. The full resources of the Museum were thus drawn upon, yet the objects taken were so few in number as not to interefere with the present museum installation.

Each series of exhibits epitomizes a single branch of art or industry and occupies a single case front or a fraction thereof, and may thus be conveniently seen at one view. The scheme of treatment or presentation is just such as the systematic student would adopt in writing the history of the subject, beginning with the inceptive stages and moving forward step by step to the highest development. The following subjects are presented, the series beginning at the left in the cases and progressing toward the right:

The use of fire. The story, illustrated in part by means of colored drawings, begins with the fire of volcanoes and lightning and the carrying of firebrands from these sources for rekindling; it is continued in a series of exhibits showing progressive steps in the making of fire which is illustrated by rubbing sticks, revolving drills, flint and steel, the lucifer match and devices for producing the electric spark.

Illumination. Two series of objects are shown, the first illustrating the torch in its many forms, arranged progressively; the second the lamp, beginning with the stone cup with oil and wick, and ending with the argand burner and the arc light.

Fishing. Of the various exploitative activities, so necessary to the sustenance of the race, only one group—the arts of fishing—is represented, others having been omitted for want of space. Series 1 illustrates the dart in its multiplicity of forms, series 2 the various toggle devices, series 3 the hook, and series 4 the sinker.

Domestic arts. Household arts are represented by four series, one epitomizing the history of cooking, and three illustrating utensils and devices employed in eating and drinking—the cup, the spoon and the knife and fork.

Tools of general use. The history of the more essential tools of human handicraft is epitomized in seven series, each beginning with the simplest forms—mere splinters and masses of stone—and ending with the highest forms—the marvelous machine-operated tools of to-day. These tools are the hammer, the ax, the adz, the knife, the saw, the drill and the scraper.

Weapons. Weapons of war have performed a most important part in the history of progress, and the steps that led up from the stone and club, held in the hand, to the steel sword and the compound machine gun are strikingly suggested in the two series presented: 1. Weapons for use in the hand—piercing and slashing weapons; and 2. Projectile weapons—the bow and arrow, the cross-bow and the pistol and gun.

Transportation—marine. The history of water transportation is epitomized in four of its leading lines of elaboration: 1. The hull, beginning with the log raft and ending with the magnificent substructure of the modern ship (represented by models). 2. Hand propulsion—the pole, the paddle and the oar (in part models). 3. The paddle wheel (models); and 4. The screw propeller (models).

Transportation—land. Land transportation is shown in six series (models): 1. The burden bearer, man and beast. 2. The sliding load. 3. The rolling load. 4. The wheeled vehicle. 5. The steam locomotive; and 6. The railway track.

The great group of elaborative activities concerned in manufacture is illustrated by four exhibits: the ceramic art, the textile art, metal work and sculpture.

Ceramic art. In this exhibit are included four series: 1. Implements and devices employed in manufacture—modeling tools, decorating tools, stamps, molds and the throwing wheel. 2. The vase, showing progressive steps in shaping and decorating and in the results of firing on paste and surface finish. 3. Glass making in its relation to ceramics; and 4. Enamel.

Textile art. Weaving is represented by three series: 1. The spindle. 2. The shuttle; and 3. The loom, the latter illustrating in a remarkable manner the rapid transition from primitive to highly developed appliances.

Metal work. The history of this important branch is partially presented in three series. 1. Metal reduction. 2. Products of manufacture showing progressive order in processes, forms and embellishments; and 3. Tools and appliances of manufacture.

Sculpture. The stone-shaping arts begin with the simplest known artificial modifications of natural forms, and advance to the achievement of the highest ideals, as represented in Greek art. Four series are shown: 1. Prehistoric stone shaping (Europe). 2. Aboriginal American sculpture. 3. Sculpture of civilized nations; and 4. Implements used in stone shaping. Series 1, 2 and 3 are separated for the purpose of contrasting the work of distinct periods and peoples.

Photography. This art, the product of advanced culture, is represented by three series of objects, epitomizing the development of: 1. The camera. 2. The lens; and 3. The picture.

The book. A limited series of objects is devoted to the history of the book; the method of assembling the several parts—the tablets and sheets—being the feature considered.

Electricity. Electrical inventions, representing one of the youngest and most marvelous branches of human activity, are shown in three limited series: 1. Experimental apparatus (Henry). 2. Transmitting apparatus (Morse and subsequent inventors); and 3. Recording apparatus.

Music. Four series are devoted to the history of as many varieties of musical instruments: 1. Wind instruments. 2. Reed instruments. 3. Stringed instruments; and 4. Percussion instruments.

The system of arranging these series is such as to make them fully intelligible to the average museum or exposition visitor. A large label or sign is framed and placed outside each case at the top; a general label for each exhibit, giving briefly the history of the subject treated, is framed and placed inside the case. Also a label explaining each progressive series is placed at the beginning of the series, and individual labels describing the specimens are placed with the specimens.

Associated with these developmental series are a number of life-size figures, modeled in plaster and appropriately costumed, intended to illustrate the practice of the arts in their primitive stages. They

give a vivid impression of primitive processes and serve to contrast these with the methods and machinery of advanced civilization. The subjects presented are as follows :

The fire maker. A Ute Indian making fire by twirling between the palms of his hands a wooden shaft, with its point set into a conical depression in a second piece of wood.

The driller. An Eskimo man, in reindeer skin costume, using a bow drill for perforating an ivory ornament.

The flint flaker. A Powhatan Indian roughing out stone implements from quartzite bowlders.

The hominy huller. A Southern Indian woman pounding corn in a wooden mortar. Figure in plaster with costume restored from drawings made by members of the Virginia colonies.

The skin dresser. A Sioux woman using a scraping or graining tool in preparing a buffalo robe.

The potter. A Papago Indian woman modeling an earthen vessel.

The metal worker. A Navajo Indian making silver ornaments. Processes probably, in part at least, introduced by whites.

The belt weaver. A Zuni girl with primitive loom weaving a belt.

These exhibits form a part of the series now in course of preparation for the National Museum, and are mere outlines of the subjects as they will finally be presented. It is conceived that a measurably full series of such exhibits will be of high educational value, giving a comprehensive notion of a large number of the greater facts of anthropology. By no other scheme of display of objective material can the whole career of the race, especially of its intellectual development—its greatest characteristic—be so clearly set forth. The objects are not assembled chronologically, but pertain to all times and to all peoples. The place of each specimen in the series is determined by its estimated relation to the successive levels of culture ; and the exhibits when completed may be taken to illustrate the full range of human accomplishment as it stands to-day or as comprehending the entire human period. These exhibits thus present the whole scope of human achievement, so far as human handiwork can express it, and serve at the same time to indicate with approximate accuracy the main steps of progress made by the race in its tedious ascent from lowest savagery to highest civilization.

W. H. Holmes.

CURRENT NOTES ON PHYSIOGRAPHY.

THE LAKES OF FRANCE.

André Delebecque, of Thonon, Haute Savoie, France, has for some years past devoted himself to the study of the lakes of his country, on which he has already written fifty odd papers. He now produces a handsome monograph, 'Les Lacs Français' (Paris, Chamerot et Renouard, 1898), the most elaborate work of its kind yet published. All the lakes of France, over 400 in number, are described ; the larger ones being studied as to location, depth, form, deposits, temperature, color and composition of water, origin of basins, and changes due to natural processes. The volume contains 22 maps and 153 figures. Under lake sediments it is well to note that, except close to the shore lines, lake bottoms are covered with an impalpable alluvium, quite like the sandstones that are often described under the head of lacustrine deposits in the Rocky Mountain region. The sub-lacustrine ravines, by which inflowing streams of low temperature and bearing glacial silts descend to the bottom of the larger lakes down the slope of their deltas, are interesting features ; they raise the question whether some other condition than 'continental elevation' may be found to

explain the much greater ravines by which the edges of continental shelves are so often notched. The Rhone, entering Lake Geneva, is visible for a little distance by its whitish color in the clear water of the lake; but it suddenly sinks and disappears about 500 feet out from its mouth. Judging by the texture of bottom deposits along the path of the descending river, its velocity at a distance of 7 kilometers from the head of the lake and at a depth of 250 meters must be 0.20 m. a second.

LAKES OF THE AUSTRIAN ALPS.

THE text by Richter to the second part of the Atlas der österreichischen Alpenseen (1896) appears in the Geographische Abhandlungen, edited by Professor Penck, of Vienna (Vol. VI., No. 2, 1897). It describes and explains the origin of the lakes and gives a detailed discussion of their temperatures. The lakes of the Drave basin are ascribed rather to barriers of drift and torrent fans than to glacial action, thus giving another example of the different conclusions as to the competence of glacial erosion reached by detailed local study and by generalizations at a distance. The Millstatter See, for example, is cut off from the aggraded valley of the Drave by the torrent fan of the Lieser. Two small lakes, Afritzen and Brenn, are similar in origin to the lakes of the upper Inn, which were explained some years ago by Heim as the indirect result of the capture of headwaters of the Inn by an encroaching Italian stream. Several of the deeper lakes show a slight rise of temperature in the bottom waters during the spring months, which Richter explains as the result of conduction of the heat from the earth's crust after the active cooling of the surface waters in winter has ceased.

THE LOB NOR CONTROVERSY.

UNDER the above title, the (London) *Geographical Journal* for June, 1898, contains an account, based chiefly on the work of Russian explorers, of the shallow lakes in the desert basin of Eastern Turkestan. The point at issue is: Which one of the several lakes of the region shall be identified as the Lob Nor of the Chinese maps; no lake being called by this name among the people of the region. This controversial matter is of less general interest than the physical features which are so well adapted to lead to controversy. A vast barren aggrading plain of sand and clay, occupying a great basin between enclosing mountains; fickle rivers which run far forward in flood and wither away in drought, occasionally turning into new channels and wandering a hundred miles from their abandoned beds; wandering sand dunes and growing deltas, disputing possession of the faint depressions with extensive reedy marshes and shallow shifting lakes; the lakes now brackish, now salt, at one time expanding, at another shrivelling; even the villages of uncertain mind, deserting an old site for a new one when invaded by dune, marsh or lake. A centenarian told one of the Russian explorers that he would not have recognized the country of his boyhood if he had returned there in his old age after spending his life abroad. Controversy naturally arises in such a geographical environment. It would then be with a new meaning that the returning traveller would sing: 'There's no place like home.'

LAKE MENDOTA.

THE use of lakes as biological stations by our inland universities promotes their physical exploration. The account of Turkey Lake, already noted in SCIENCE, is now followed by 'Plankton Studies on Lake Mendota,' by Birge (Trans. Wisc. Acad. Sci., XI., 1897, 274–448, of which 286–300 are on lake temperatures). The depth of the lake is 18 meters. In May there is a rapid gain of heat through the whole water body; dur-

ing mid-summer the surface waters reach a temperature of 23° C., the bottom waters being 14° or 15°. The lake is at this time in stable equilibrium and the stagnant bottom waters are unfit for most forms of life. But by the end of September the surface has cooled so that a uniform temperature prevails from top to bottom; then gales easily overturn the water body and it slowly cools as a 'homothermous' mass to the winter minimum.

W. M. Davis.

CURRENT NOTES ON METEOROLOGY.

CLIMATIC CONTROL OF TRANSPORTATION IN NORTHERN RUSSIA.

From a recent book, entitled 'A Northern Highway of the Tzar,' by Trevor-Battye (London, Constable, 1898), there is much of interest to be learned concerning the marked control which the climatic condition of northern Russia in October exert over transportation and over the occupations of the inhabitants. October is known in that region as the Rasputnya season, Rasputnya meaning literally 'the separation of the roads.' At this season 'the first frosts have thawed and the first snows melted,' streams of broken ice block the rivers, the morasses are like quagmires; 'the tracks, where any advance has been attempted upon old forest bog, a mixture of treacle and glue.' There is an almost complete interruption of travel, owing to the condition of the roads and streams, until the settled frost of winter has united the land and the water into one solid frozen surface. "During the whole of October the government postal service is stopped, labor contracts are off, and the keepers of the stages are entirely freed from their usual obligation to supply the traveller with horses and sleighs." The control over transportation, here brought out in one of its aspects, is an important relation of climate and man which has not yet received the careful study it deserves.

KITE METEOROLOGY IN THE ANTARCTIC.

In *Das Wetter* for May, Sprung advocates the use of kites on the proposed Antarctic expeditions, for the purpose of securing accurate data as to the vertical temperature gradient in high southern latitudes. At present the calculation of the pressures at altitudes of 2,000–4,000 meters in these latitudes leads to rather unsatisfactory results, owing to the uncertainty which exists concerning the actual temperatures prevailing there above the earth's surface. By the use of thermographs elevated on kite lines, as has been so successfully done at Blue Hill, it would be possible to obtain accurate temperature data from the free air at considerable altitudes, and these observations could be used in calculating the pressures aloft with a considerable degree of accuracy.

AURORAS IN LONDON FROM 1707 TO 1895.

A recent paper by Mossman, on 'The Aurora Borealis in London from 1707 to 1895,' (*Journal Scottish Meteorological Society*, Nos. 13 and 14, 1897), shows that the maximum numbers were observed in 1848, 1787, 1789 and 1872. Auroras are most frequent in October and April, and least frequent in December and June.

R. DeC. Ward.

Harvard University.

CURRENT NOTES ON ANTHROPOLOGY.

THE ARCHÆOLOGY OF GUERRERO.

The State of Guerrero lies on the Pacific, directly south of the City of Mexico. Before the Conquest it was peopled by the Mixtecs, who had a picture writing of their own; by the Nahuas, who were in the majority; and by lesser tribes. The Mexican antiquary, Orozco y Berra, writing thirty-five years ago, asserted his belief that within its area would be found one of the oldest sites of the American race (*Geografia de las Lenguas*, p. 239).

Especial interest, therefore, attaches to

Mr. William Niven's archæological researches in that State. A sketch of them is given in the periodical *Modern Mexico*, for May, 1898. I have previously referred to his article on Omitlan (SCIENCE, December 10, 1897). West of Chihihualco he found ruins of a similar character, that is, built of stone with firm cement, on all the prominent ridges and hills. He also describes a cave containing old deposits of skeletons, some of the skulls singularly deformed by artificial means. A complete investigation of such relics is much to be desired.

THE QUICHE LANGUAGE.

THIS language is spoken in western Guatemala, and is a dialect of the Maya stock. For archæologists it has peculiar interest, as the ancient Quiches were quite civilized, and their mythology has been preserved in the remarkable 'Popol Vuh,' or National Book, edited by the late Abbé Brasseur de Bourbourg.

For these reasons, students will be pleased to learn that the British and Foreign Bible Society has published in Guatemala a translation of the Gospel of St. Mark into the tongue, the Spanish and Quiche being printed in parallel columns. The translation was made, I understand, by Mr. F. de P. Castells, agent of the Society, or under his supervision. Ordinary type is used, the phonetic values of the letters being sometimes from the Spanish, sometimes from the English, and the gutturals indicated by compound consonants or by different fonts.

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SCIENTIFIC NOTES AND NEWS.

IMPORTANT VERTEBRATE FOSSILS FOR THE NATIONAL MUSEUM.

PROFESSOR O. C. MARSH has recently transmitted from New Haven to the Director of the United States Geological Survey the fourth large instalment of Vertebrate Fossils secured in the West, in 1882–92, under his direction, as Paleontologist of the United States Geological Survey in charge of Vertebrate Paleontology. The collection is packed in one hundred (100) boxes, and weighs over thirteen (13) tons. In accordance with law, the material will be deposited in the National Museum. This collection includes twelve sculls and other remains of the gigantic *Ceratopsia* from the Cretaceous; various *Dinocerata* fossils from the Eocene; a series of rare specimens of *Brontotherium*, *Elotherium*, *Miohippus* and other genera from the Miocene; a very extensive collection of Rhinoceros and other mammals from the Pliocene, as well as various interesting fossils from more recent deposits.

The other important collections of vertebrate fossils secured by Professor Marsh in the West for the Geological Survey, and previously transferred to the National Museum, may be briefly enumerated as follows:

(1) Seventy-two (72) large boxes of Pliocene fossils, weighing about 7,500 pounds, were transferred December 31, 1886, and were stored in the Armory February 8, 1887. The record of these boxes is on file in the office of the Geological Survey, and the Smithsonian numbers of the boxes are 6,601–6,672.

(2) Thirty-three (33) large boxes (weighing 6,960 pounds), of rare vertebrate fossils, ready for exhibition, were transferred July 17, 1891, and were placed in a case specially prepared for them in the National Museum, before the opening of the International Congress of Geologists held in Washington that year.

(3) Forty-three (43) large boxes (weighing 4,380 pounds) of Pliocene vertebrate fossils were transferred April 17, 1896.

These various collections, with other smaller consignments transferred to the National Museum (255 boxes in all, with a total weight of over 20 tons), were secured under the special direction of Professor Marsh, as Paleontologist of the United States Geological Survey in charge of vertebrate paleontology, during 1882–92. The remaining collections thus made, and still at New Haven, will be sent to Washington as soon as their scientific investigation, now in progress, is completed.

PROFESSOR KOCH ON MALARIA.

Professor Koch, who, as we have reported, has recently returned from German East Africa, addressed the Colonial Society of Berlin on June 9th, on the subject of malaria in the tropics. He stated, according to the London *Times*, that he had found the study of Texas fever in cattle of the greatest assistance in casting light upon the nature and origin of tropical malaria. That cattle disease had been found to be transferred from one herd to another solely by the agency of that animal parasite, the tick. He had been able to infect sound cattle with ticks taken from diseased ones, and had succeeded in conferring immunity against Texas fever upon cattle inoculated with the ova of ticks taken from cattle which were suffering from the disease. Malaria offered many points of resemblance to Texas fever, and he had arrived at the conclusion that in the case of the human disease mosquitoes probably played the part which ticks played in the cattle disease. It was found that wherever there were mosquitoes there was malaria, and wherever, as in the case of a small island on the German East African coast, there were no mosquitoes there was also no malaria.

He had taken occasion to follow closely the course of cases of tropical malaria in which the use of quinine was dispensed with. He found that, contrary to the view hitherto accepted, the cases where quinine was not used showed that in malaria, as in other fevers, the readings of temperature followed a definite course. Moreover, it had been found possible by a microscopic examination of the blood of the patient to discover from the nature of the microbes it contained the precise stage of the development of the disease. This would be of the greatest importance, since everything depended upon the administration of quinine either shortly before the attack or very shortly after it. It would ultimately, he thought, be possible to administer quinine in a rational manner and so to avoid the injurious consequences of the quinine treatment. Quinine taken at the proper juncture undoubtedly stopped the malarial fever. It did so, not by killing the germs, but by arresting their growth. A rational and scientific employment of quinine, combined with the establishment of health resorts in the mountains, would rob tropical fever of many of its terrors. Professor Koch further discussed what is designated in German *Schwarzwasserfieber*. According to his view this fever is not connected with malaria at all, but is the result, in all probability, of the quinine treatment. In any event, there was no case of this fever in which it could be safely asserted that quinine poisoning was not present.

As to the possibility of securing immunity from malaria, he called attention to the fact that whole native tribes seemed to be proof against the infection. But if a natural immunity existed it was reasonable to hope that an artificial one might be created. It had been observed, for example, that persons who had suffered from malaria and had made a gradual and slow recovery without the aid of quinine often acquired entire immunity from the disease. In order that progress should be made in combating the ravages of malaria, it was indispensable that doctors trained in bacteriology and in the use of the microscope should be sent to East Africa. The administration of quinine by non-professional hands was a great mistake. If science were one day to cope successfully with this disease it would facilitate the prosperous development of some of the most fruitful districts in the world.

BIBLIOGRAPHICAL DATA FOR THE TITLE-PAGES OF BOOKS.

The Publishers' Association of Great Britain has adopted arrangements for the bibliographical details given on title-pages of books, which we reproduce here, as they are of special importance in the case of scientific books. It is to be hoped that they will be insisted on by men of science and followed by American publishers. The recommendations are as follows:

(1) *Date.*—(*a*) That the title-page of every book should bear the date of the year of publication, *i.e.*, of the year in which the impression, or the reissue, of which it forms a part, was first put on the market. (*b*) That when stock is reissued in a new form the title-page should bear the date of the new issue, and each copy should be described as a 'reissue,' either on the title-page or in a bibliographical note. (*c*)

That the date at which a book was last revised should be indicated either on the title-page or in a bibliographical note.

(2) *Bibliographical Note.*—That the bibliographical note should, when possible, be printed on the back of the title-page, in order that it might not be separated therefrom in binding.

(3) *Impression, Edition, Reissue.*—That for bibliographical purposes definite meanings should be attached to these words when used on a title-page, and the following are recommended: *Impression.*—A number of copies printed at any one time. When a book is reprinted without change it should be called a new *impression*, to distinguish it from an *edition*, as defined below. *Edition.*—An impression in which the matter has undergone some change, or for which the type has been reset. *Reissue.*—A republication at a different price, or in a different form, of part of an impression which has already been placed on the market.

(4) *Localization.*—When the circulation of an impression of a book is limited by agreement to a particular area, that each copy of that impression should bear a conspicuous notice to that effect.

Addendum.—In cases where a book has been reprinted many times, and revised a less number of times, it is suggested that the intimation to that effect should be as follows: *e.g.*, *Fifteenth Impression* (*Third Edition*). This would indicate that the book had been printed fifteen times, and that in the course of those fifteen impressions it had been revised or altered twice.

GENERAL.

THE Academy of Natural Sciences of Philadelphia has received from Miss Anna T. Jeanes a gift of $20,000, to be invested and known as the Mary Jeanes Museum Fund, the income to be used for general museum purposes. This is a gratifying instance of continued interest in the welfare of the Academy, which has received substantial benefits from members of Miss Jeanes' family during the last forty-five years.

THE conference of astronomers and physicists held at the Yerkes Observatory in 1897 was so successful that it has been decided to hold a conference this year at Harvard College Observatory. It will be in session on Thursday, August 18th, and the two following days, being thus simultaneous with the meeting of the American Mathematical Society and immediately preceding that of the American Association.

THE fund collected for the Huxley Memorial now amounts to £3,346. The marble statue to be placed in the Natural History Museum is being carried out by Mr. Onslow Ford, and the medal for the Royal College of Science has been completed by Mr. F. Bowcher. About £1,300, which it is hoped will be materially increased, will be left and will be used for a third memorial. The Scientific Memoirs, making a fourth memorial, are, as we have already stated, in course of publication by Messrs. Macmillan & Co.

THE Academy of Natural Sciences of Philadelphia has conferred the Hayden Memorial Geological Award for 1898, consisting of a bronze medal and the interest of the endowment fund on Professor Otto Martin Torell, the Director of the Geological Survey of Sweden, in recognition of his distinguished services to geological science.

HARVARD UNIVERSITY has conferred the degree of Doctor of Laws on the eminent chemist, President James Mason Crafts, of the Massachusetts Institute of Technology.

PROFESSOR O. C. MARSH, of Yale University, has been elected an honorary member of the Geological Society of London.

THE Paris Academy of Sciences has nominated as its first choice M. Lippmann, and as second choice M. Appell, for the vacant place in the membership of the *Bureau des longitudes.*

PROFESSOR H. A. LORENTZ, of Leyden, and M. Émile Picard, of Paris, have been elected foreign members of the London Mathematical Society.

PROFESSOR A. WEISMANN, Professor B. Grassi and M. Hippolyte Lucas have been elected honorary members of the London Entomological Society.

Nature announces the death, at the age of seventy-two, of Sir James Nicholas Douglass, F. R. S., late Engineer-in-Chief to the Hon. Corporation of Trinity House. During his ten-

ure of this post he carried out many important engineering works, both at home and abroad, such as the Wolf, Longships, Great and Little Basses, Eddystone, and Muricoy lighthouses, and he effected numerous technical improvements connected with lighthouses and their illuminating apparatus, as well as in buoys and beacons. He was elected a Fellow of the Royal Society in 1883, and retired from his post at the Trinity House in 1892.

The New York Aquarium has received by the steamship *Orinoco* an interesting collection of tropical fish, sent by Professor Bristol, of New York University, from the Bermudas.

The tables at the Naples Zoological Station, supported by the University of Cambridge, have been given to Mr. C. H. Hadfield, of Trinity College, and Mr. R. C. Punnett, of Gonville and Caius College.

Busts of Skoda and Rokitansky were unveiled in the Arcades of the University of Vienna at the beginning of June. The *Philadelphia Medical Journal* states that Professor Nothnagel and Professor Weichselbaum delivered the memorial addresses on the occasion for the respective representatives of their specialties. Of Skoda, Nothnagel said: "He was the Lessing of clinical medicine; at once an originator and a critic, of wonderful clearness of comprehension, of untrammeled devotion to truth for its own sake, and of judicial mental acuity. He was the introducer into clinical medicine of exact scientific methods."

A prize of £2,000 is offered by the North of Scotland malt distillers to chemists residing in any country who will devise a successful method for the purification of their waste products. The distillers have been forbidden to empty these into the streams.

The United States Civil Service Commission announces that it is desired to establish an eligible register from which a selection may be made to fill the grade of Assistant, Division of Entomology, Department of Agriculture, at a salary of $1,000 per annum. No educational test will be given, but applicants will be graded upon the subjects of drawing of insects and wood engraving of insects, together with their technical knowledge of the order Heteroptera. Applicants will be required to furnish samples of their work covered by the first two subjects, and they will submit on a special form prepared by the Commission a statement showing their technical knowledge of the last-named subject. They will also be required to submit a statement in the form of an affidavit that the work has been performed by them without aid from any one. Application must be made not later than July 21st.

In connection with a notice of Professor Hale's address on 'The Function of Large Telescopes' (Science, May 13, 1898) *Nature* quotes from the *Observer* the statement that in the number of refractors exceeding 13.4 inches America comes first, France second, England third and Germany fourth.

The yacht *Windward* sailed from New York on July 2d and will be met by Lieutenant Peary at Cape Breton. The steamship *Hope* with supplies and coal had previously sailed, and will join the *Windward* at North Baffin's Bay.

The Norwegian Geographical Society gave a banquet on June 21st to the expedition under Captain Sverdrup, which was on the point of leaving for exploration along the north and northwest coast of Greenland. The London *Times* says that several of the Norwegian Ministers were present, as well as the Presidents of the two Houses of Parliament, and Dr. Nansen and other distinguished men. Professor Mohn, the eminent meteorologist, made an interesting speech in proposing success to the expedition. Captain Sverdrup, in his reply, said that he would do his best, with the aid of his able staff, to bring back varied and valuable scientific results and to put some color on the great white space to the north of Greenland. The speech of the evening was, of course, that by Dr. Nansen, who was listened to with intense interest as he dwelt on the strange feelings which animated him on seeing the *Fram* go out once more under his trusty and brave comrade Sverdrup. He dwelt on Sverdrup's gallant exploits, both on the expedition across Greenland and on that in the *Fram*, in the success of which Sverdrup had so large a share. The *Fram* was now better fitted out in every way

than it had been on the last memorable drift in the great Arctic current, and he was confident that his friend and comrade would bring back great results.

MR. A. P. LOW, of the Geological Survey of the Dominion of Canada, has gone to Labrador, where he will remain for eighteen months, in order to study the geological formations and make a map of the region.

As we have recently referred on several occasions to the conferring of the Prussion order *Pour le merite*, it may be well to quote from *Nature* the following details regarding this order: Founded by Frederick the Great, it was at first given for military service only, but its statutes were remodeled in 1842 by King Frederick William IV., and the class 'für Wissenschaften und Künste' was instituted. The German knights of this class, with whom the election into the Order practically rests, are limited to thirty in number, and at present are: A. Menzel, Chancellor; T. Mommsen, Vice-Chancellor; the other members in the order of election being, in the Section of Science: R. W. Bunsen, Max Müller, E. Zeller, T. Noeldeke, J. V. du Vernois, A. Auwers, E. Pflüger, H. Vogel, A. v. Baeyer, O. Fürst v. Bismarck, F. Kohlrausch, H. Grimm, H. Brunner, A. v. Kölliker, H. Usener, W. Hittorf, A. Weber, C. Neumann and Schwendener. In the Section of Art: L. Knaus, A. Achenbach, J. Schilling, R. Begas, F. Schaper, E. v. Gebhardt, H. Ende and A. Hildebrand. The foreign knights, limited to the same number, are, in the Section of Science: O. v. Boethlingk, C. Hermite, Sir G. G. Stokes, N. A. E. v. Nordenskjöld, M. Berthelot, O. v. Struve, Lord Kelvin, Lord Lister, V. Jagic, P. Villari, H. Kern, J. G. Agardh, M. J. de Goeje, G. V. Schiaparelli, F. Imhoof-Blumer, J. H. van't Hoff, A. O. Kowalevsky, W. Stubbs (Bishop of Oxford), O. Montelius, Sir ohn Murray and Sir W. H. Flower. In the Section of Art: L. Alma Tadema, G. Verdi, G. Monteverde, E. Wauters, L. Passini and F. Pradilla.

THE French government has appointed the following as delegates to the International Congress of Zoology: M. A. Milne-Edwards, membre de l'Institut, Directeur du Muséum d'Histoire Naturelle de Paris, Vice-Président de la Section des Sciences du Comité des Travaux Historiques et Scientifiques, Président de la Délégation; M. Barrois, Professeur à la Faculté mixte de Médecine et de Pharmacie de l'Université de Lille; M. Bigot, Professeur à la Faculté des Sciences de l'Université de Clermont; M. R. Blanchard, membre de l'Académie de Médecine, Professeur à la Faculté de Médecine de l'Université de Paris, Sec. Général de la Société Zool. de France; M. A. Caullery, Maître de Conférences á la Faculté des Sciences de l'Université de Lyon; M. Y. Delage, Professeur á la Faculté des Sciences de l'Université de Paris; M. Filhol, membre de l'Institut, Professeur au Muséum d'Histoire Naturelle de Paris; M. Girod, Professeur à la Faculté des Sciences de l'Université de Clermont; M. le Baron J. de Guerne, membre de la Société Zool. de France, Sec. Général de la Société d'Acclimatation; M. Joubin, Professeur à la Faculté des Sciences de l'Université de Rennes; M. Lambert, Agrégé près la Faculté de Médecine de l'Université de Nancy; Dr. Lartet, Doyen de la Faculté mixte de Médecine et de Pharmacie de l'Université de Lyon, Professeur à cette Faculté; M. Edmond Perrier, membre de l'Institute, Professeur au Muséum d'Histoire Naturelle de Paris; M. Roule, Professeur à la Faculté des Sciences de l'Université de Toulouse; M. Schlumberger, membre de la Société Zool. de France; M. Léon Vaillant, Professeur au Muséum d'Histoire Naturelle de Paris, Sec. de la Section des Sciences du Comité des Travaux Historiques et Scientifiques de la Société Zool. de France; M. Ch. Janet, Vice-Président de la Société Zool. de France.

IN the Museum of the Scarborough Philosophical and Archælogical Society, says *Natural Science*, Mr. C. D. Head has been replacing the old and ruinous collection of birds by cases displaying them, so far as possible, in their natural habitat, with their nests and eggs, when these can be obtained. An improvement has also been made in the cases for the fossils. The Society records the capture of two badgers —one at Cloughton, the other near Folkton. The record of local birds has been placed upon a more satisfactory basis, every item contained in the list being thoroughly authenticated. Fish,

both sea and fresh-water, also are being studied; Mr. F. Grant records the occurrence of various species not hitherto observed. Considerable attention is also paid by members of the Society to the Invertebrata of various Classes, though naturally the land and fresh-water Mollusca and the Lepidoptera come in for the giant's share. The geologists have paid attention to the exposures during the making of the Marine Drive, but not many fossils have yet been found.

We learn from the *Experiment Station Record* that Congress has continued and increased the appropriation for investigations in Alaska with reference to the establishment of agricultural experiment stations there. Professor C. C. Georgeson, formerly professor of agriculture in the Kansas Agricultural College, has been assigned to this office as special agent in charge of the Alaska investigations. He will make his headquarters at Sitka, and will institute experiments with cereals, vegetables and other crops at a number of places in that vicinity. He will also visit Kadiak Island, Cook Inlet and other points north of Sitka, with reference to the selection of land for experimental purposes and the institution of experiments with the cooperation of residents of Alaska interested in the development of its agriculture. Questions relating to the temperature, moisture and drainage of the soil, the curing and storage of forage plants, and the shelter and care of animals will receive early attention. The Weather Bureau will also establish a special climatological service in Alaska during the present season. A meteorological station will be located at Sitka and instruments will be furnished to voluntary observers in different parts of Alaska. In this way observations will be regularly made, which it is hoped will be of much service in the solution of agricultural problems, as well as of great importance to other interests in Alaska.

Lummer and Brodhun, the extreme accuracy of whose work in photometric investigations is well known, have studied Talbot's Law by methods so exact that the mean error of observation is at most ½ %, and find that the departures from the law fall well within that limit. They have before been found to fall within the limit of error, but when that limit was three to eight per cent. the law could not well be considered to be absolutely confirmed. The present confirmation holds only for sectors from twenty-five to ninety degrees in breadth; when the sectors are very narrow, diffraction from the edges has to be taken account of. As rotating sectors present the best method for securing a measurable change of brightness upon the photometric screen (it is easily combined with any apparatus, can be introduced anywhere in the course of the light rays, does not change the character of the light, so that it is not necessary to attend to conditions of polarization, and diminishes all light rays equally and in accordance with a simple law), the authors have devised a very exact apparatus by which the size of the sectors can be continuously varied during rotation; this has been in use for some time, and is found to work well.

Mr. Newstead, Curator of Chester Museum, England, who has made an exhaustive study of the San José scale pest, has been lecturing on the subject before the Zoological Section of the Chester Society of Natural Science. According to the London *Times* Mr. Newstead, who has had an interview with Mr. Long, Minister of Agriculture, and his advisers at the Board, said he had suggested that the government should engage a staff of trained workers to detect suspicious imports of fruit and submit them for expert examination. The origin of the American fruit pest scare was due to the action of Germany in March of the present year. That country had passed a law protecting itself from the importation of infested fruit. The oyster scale which infested some fruit trees resembled the San José so closely that it was impossible to distinguish one from the other except by microscopical examination. If a tree was infested by the insects a sort of scurfy material would come away, which was really their wax-like scales. The actual size of the insect was a millimeter in length, which meant that it would not cover the head of an ordinary pin. Mr. Newstead explained the life-history of the insect, showing that after two days of activity in the larval stage it became an inert fixed mass, living in the same place for the rest of its life

and sustaining itself on the tree juice, which in time stunted and diseased the tree. During one season a single female insect was capable of producing 500 or 600 young, and in some parts of America there were five or six broodings. Its presence had been recorded in three places out of America—Australia, Chile, and one of the Western Islands. He did not think it would thrive in England, but it was very desirable to prevent its introduction.

THE University of London has excluded mental and moral science from the list of subjects that may be offered for the University's degrees in science. A memorial protesting against this action has been presented, in the course of which it is said: "By its attitude in the past the University of London has not a little encouraged the more strictly scientific study of psychology, both as a science of observation and in its relation to physiology. Among students of physical science a certain number have a distinct taste for philosophical study, and it is desirable to encourage such students with a view to the development both of scientific methodology and of psychology on its experimental and physiological side. The student who approaches the mental sciences from the literary side deals with them naturally in a different spirit. For the development of the subject in its relation to the general body of science it is necessary that it should be studied by some who are familiar with the principles and methods of physical science. At the present time much scientific labor of this kind is being spent on psychological inquiry in other countries. In most of the principal universities of Continental Europe and America psychological laboratories have been founded at considerable expense, and foreign journals are published for the express purpose of recording experimental work in psychology. In this country efforts are being made to develop a similar line of study. The University of Cambridge has recently appointed a lecturer in experimental psychology, and a laboratory has been opened this session at University College. To all such efforts this sudden *volte face* of your University is a serious blow. We venture, therefore, respectfully to express our hope that you will readmit mental and moral science into the schedule for the science degrees, with such modifications, should they be deemed necessary, as may serve to accentuate the scientific sense in which the subject should be treated for the purpose of a degree in science." Amongst those who have signed the memorial are the Master of Balliol, Professor Henry Sidgwick, Mr. R. B. Haldane, Q.C., M.P., Professor Burdon Sanderson, Professor William Ramsay, Professor F. Y. Edgeworth, Mr. Francis Galton, Dr. A. Robertson, Principal of King's College, Professor Sully, Mrs. Sophie Bryant, D.Sc., Mr. C. Lloyd Morgan, Professor Foxwell, Mr. Bernard Bosanquet and Professor Oliver Lodge.

THE official opening by Sir Owen Tudor Burne of the exhibition of acetylene gas apparatus and production at the Imperial Institute took place on Wednesday, June 15th, when a considerable number of generators of various types were to be seen in operation. We learn from the London *Times* that these are arranged in a building in the southwest quadrangle, and each set of apparatus is connected by its own separate service pipe to its own gaselier in one of the gallieries so as to enable the public to judge of the quality and steadiness of the light produced by each installation. A number of portable generators and self-contained lamps are also on view, together with several forms of bicycle lamp. All the apparatus, before being admitted to the exhibition, had to fulfil certain conditions of safety deemed necessary by a committee of scientific men appointed by the Society of Arts and including, among others, Sir Frederick Bramwell, Professor James Dewar, Mr. Harry Jones, Professor Vivian B. Lewes and Mr. Boverton Redwood. This committee formulated certain rules to be observed in the construction of all generators, and the London County Council gave it permission to use a portion of their premises at 211 Harrow-road for the purpose of carrying out the necessary tests. While the committee in this way sought to ensure that none but safe types of machine were shown at the Institute, it did not touch the question of the efficiency of the various designs. This is to be tested during the exhibition. It is intended to keep a daily record of all apparatus at work, in accordance with the directions laid down by the committee,

and to issue a report on the results of the working. The exhibition will remain open till August 15th.

The acetylene exhibition, which was originally planned for Cannstadt, near Stuttgart, took place at Berlin on the Kurfürstendamm, says the *Scientific American*, in connection with an acetylene conference. Acetylene generators were exhibited by thirty firms, but most of them were not shown in operation, owing to the strict regulations enforced by the police. The generators in action had each to be shown in a special compartment not accessible to the general public, behind a strong wall. This was not in itself calculated to inspire the citizens of Berlin with a very happy idea of the safety of the new illuminant. Progress could be recognized in the exhibits, but as yet there does not appear to be any special type which is the favorite. Acetylene purifiers proved to be necessary adjuncts. Among the impurities of acetylene less thought of in general is phosphureted hydrogen. In spite of purifying, the hall every evening was foggy with the fine dust of the phosphoric acid. Next year the meeting will be held at Budapest.

It is, perhaps, not generally known, says the *British Medical Journal*, that Professor Charles Richet, who delivered an address on The Work of Pasteur and the Modern Conception of Medicine at the annual meeting in Montreal, is a novelist and a dramatic author as well as a physiologist of the first rank. Under the pseudonym of 'Charles Epheyre' he has gained a considerable reputation in contemporary French literature. His most successful novel, *La Douleur des Autres*, was published in 1896, having first appeared serially as a *feuilleton* in the *Indépendance Belge*. Among his other works of fiction may be mentioned *Sœur Marthe*, the plot of which turns on the love of a physician for a hypnotizable patient; *Amour de Garnison*, *Bonne et Mauvaise Étoile*, *A la Recherche de la Gloire*, and *Le Microbe et le Mirosaurus*. 'Charles Epheyre's' last play, *Judith*, written in collaboration with M. Octave Houdaille, was produced at the Bodinière Theatre on March 28, 1898. Professor Richet is also the author of *L'Homme et l'Intelligence* and other works on psychology, and the Editor of the *Revue Scientifique*.

At the Royal Geographical Society, on April 27th, a paper was read by Dr. Sambon on 'Acclimatization of the white man in tropical lands.' Within recent times, he said, according to the report in the London *Times*, sanitation had wrought wonderful changes in the healthiness of all tropical countries. They had been considered unfit for the permanent settlement of white men on account of their climate, or, to be more correct, on account of their heat, because the word climate had been used as synonymous with heat. Heat was supposed to induce deterioration and diseases, such as anæmia, liver abscess and sunstroke. But anæmia was not due to heat, being in the tropics a symptom common to several parasitic diseases. Liver abscess was likewise of parasitic origin and sunstroke was a microbic disease, however paradoxical the statement might appear, on account of the mistaken etiology perpetuated by an erroneous nomenclature. As for deterioration, it was far more alarming in the overcrowded cities of the Old World than in tropical colonies. The geographical distribution of tropical diseases was of the greatest importance in the study of acclimatization. Diseases being due to living organisms that had their peculiar dissemination like all other forms of life. This distribution was likewise determined by a variety of circumstances, among which meteorological conditions were certainly important, but association and competition more so. Under proper management European children did very well in tropical colonies, in the most unhealthy of which infant mortality was lower than in some districts of Europe. The belief, again, that white men could not labor in the tropics was disproved by facts. That man was capable of adaptation to a new climate was shown by the fact that he had constantly moved from one region to another. If attempts at colonization in the past had often been unsuccessful and always cost immense sacrifice in lives and money, it was because they had been made in complete ignorance of the conditions essential to success. Acclimatization was a mere question of hygiene, and what was needed above all was a complete

knowledge of tropical diseases. A discussion followed.

UNIVERSITY AND EDUCATIONAL NEWS.

THE University of London Commission Bill has passed the second reading in the British House of Commons without a division.

CAMBRIDGE UNIVERSITY has received a bequest of £10,000 for the foundation of a scholarship or prizes.

THE Wawepex Society has given $200 for a scholarship in biology at the Coldspring Laboratory of Biology, to be filled by a graduate student of Columbia University. Mr. F. B. Sumner has received the appointment.

THE chair of botany in the University of Wisconsin, vacant by the removal of Professor Charles R. Barnes to the University of Wisconsin, has been filled by the election of Dr. R. A. Harper, of Lake Forest University.

DR. ALEX. HILL, master of Downing College and an eminent physiologist, has been re-elected Vice-Chancellor of Cambridge University for the ensuing academical year.

MR. R. PENDLEBURY and Mr. A. E. H. Love, F.R.S., fellows and lecturers in St. John's College, have been appointed University lecturers in mathematics.

PRINCIPAL CAIRD will on August 1st retire from the principalship of Glasgow University.

MISS GERTRUDE HALLEY has been appointed one of the demonstrators in anatomy in Melbourne University.

M. P.-M. LABATUT has been given charge of the instruction of physics and chemistry in the medical school of Grenoble.

SCIENTIFIC LITERATURE.

La Mathematique; philosophie, enseignement. Par C.-A. LAISANT, repetiteur à l'école polytechnique, docteur és sciences. Paris, George Carré et C. Naud. 1898. Pp. 292.

The above work consists of three parts: the philosophy of pure mathematics, the philosophy of applied mathematics, and the teaching of mathematics. The first part is subdivided into the following chapters: Mathematics and its Divisions, Arithmetic and Arithmology, Algebra, Infinitesimal Calculus, Theory of Functions, Geometry, Analytical Geometry, Rational Mechanics. The second part is divided into General Considerations, Application of the Calculus, Application of Geometry, Application of Mechanics, and the third into General View of the Teaching of Mathematics, Teaching of Arithmetic, Teaching of Algebra and the higher Calculus, Teaching of Geometry, Teaching of Analytical Geometry, Teaching of Mechanics, the Hierarchy of Education.

In an introductory chapter M. Laisant sets forth the aim of the book. He says that he does not write for those who are deeply versed in mathematical science, nor those who are ignorant of it, but for a middle class, namely, those who are studying mathematics or have studied it and whose knowledge and interest are kept alive by teaching it or by being engaged in work requiring its application. It may be said, however, that whatever is written on the philosophy of mathematics by so eminent a master of geometric algebra and distinguished investigator of the hyperbolic functions cannot fail to be of interest to the professional mathematician; and even the mere seeker after culture will find in this volume many things to arouse his interest in the most perfect of all the sciences.

In traversing the domain above described the author discusses many questions of scientific and educational interest; in this notice there is only room to mention a few. One of the first points he makes is that it is not correct to speak of the mathematical sciences, as they all aid one another, give mutual support, and in certain parts blend together; there is but one vast science, which no one can flatter himself to master completely, for its conquests are infinite in nature.

M. Laisant does not pretend to be a professional philosopher, but he has read the works of Leibnitz, Descartes, Pascal, D'Alembert, Diderot, Condorcet, Comte, each of whom was a philosopher, and likewise left a brilliant record in mathematical science; in this volume we have the digested results of his reading and reflection. Work of the character described is the most valuable kind of philosophy, and very rare in these times, for the saying of Leibnitz

is as true now as ever: "Sans les mathématiques ou ne pênètre point au fond de la philosophie; sans la philosophie on ne pênètre point au fond des mathématiques; sans les deux, on ne pênètre au fond de rien."

The author bases the plan of the volume on an opposition between pure mathematics and applied mathematics. It is pure mathematics which furnishes us with infallible formulas and deductions; it is applied mathematics which completes the work by showing the necessary existence of errors. The distinction made is largely that between rational and empirical laws in physics. It is not that the one is independent of experience and the other dependent on it; for both are based on experience (p. 10). Why the formulas of the one are infallible, while those of the other are not, is not made very clear.

The author is not satisfied with any of the current definitions of mathematics, but prefers to describe it by means of its object. The essential object of all science, according to M. Laisant, is the study of the phenomena presented by the external world; and the mathematical treatment of these phenomena consists of three stages: forming the equations, solving the equations, interpreting the results.

As regards the importance of mathematical science, the author quotes the saying of Kant: "A natural science is a science only so far as it is mathematical," and that other saying attributed to Napoleon the First: "The advancement and progress of mathematics are bound up with the prosperity of the State." According to M. Laisant it is the most marvelous instrument created by the genius of man to aid in the discovery of the truth.

At page 30 the author takes the ratio or relative view of algebraic quantity and is led to look upon multiplication as the formation of a number (the product) which has to the multiplicand the same ratio as that which the multiplier has to unity. While this may be sufficient for elementary arithmetic, it does not satisfy the calculus of the mathematical physicist, for with him a symbol stands for a magnitude of some kind, not for its ratio to some supposed unit.

The author criticises in vigorous terms the procedure adopted by some of giving mathematics a definitional or ideal basis. It is marching in the direction opposite to progress, and is a revival of the attitude of the sophist. Algebra is not one, but several, because the properties of the quantities which it treats are different in their nature. Thus the rules of the method of quaternions differ from those of algebra not by arbitrary definition, but because the geometry of space demands it. At another place the author suggests that the method of quaternions when more fully developed is certain to modify and advance the theory of functions.

The author says that the fundamental error of the ancient geometers was that they did not recognize the experimental element which is at the base of geometry; when it is recognized, the non-Euclidean geometry becomes a logical possibility.

What is said on the teaching of mathematics refers to France, but much of it is valid everywhere. In the domain of primary mathematics the pupil ought to be interested, encouraged to make research, be given the feeling—the illusion, if you will—that he is discovering for himself what he is being taught. This demands in the first place a teacher of a high order, and in the second place that the class be small and homogeneous. When the class become a flock and the teacher a shepherd's dog, no progress is possible. The fundamental principles ought to be singled out and exhibited in all their relations, and their meaning made clear by frequent applications. Memory ought to play a very subordinate part; it is the understanding which ought to be exercised. In the domain of the more advanced instruction he does not favor the study of a text-book, still less dictated lessons. He recommends notes taken by the pupil of oral lessons. In the highest domain he recommends the taking of notes, supplemented by a text-book.

For the first introduction to arithmetic he recommends a rigorously experimental method; to have the child to make his own notions in the presence of realities which he can touch and see, to demonstrate nothing, and to make the instruction have the appearance of play rather than of work. In this way a firm

foundation is laid for the teaching of the principles and rules.

In the teaching of algebra he would make plain the theory of imaginaries, when the extraction of the square root comes up; and would introduce an exposition of geometric quantity before taking up the equation of the second degree. He predicts that the day when the geometric calculus will be introduced in the regular course of instruction is not far off. In the concluding chapter he deplores the too great centralization of mathematics in Paris to the injury of the rest of France.

In conclusion we recommend the volume to the notice of every live mathematician, and to every one interested in the nature of human knowledge.

ALEXANDER MACFARLANE.

Elements of Comparative Zoology. By J. S. KINGSLEY, S.D., Professor of Zoology in Tufts College. New York, Henry Holt & Co. 1897.

This book of 357 pages embodies an attempt to combine the text-book proper with the laboratory manual in such proportions as to meet the demand of the beginner. It is contended in the preface that "a knowledge of isolated facts, no matter how extensive, is of little value in education, excepting as the powers of observation are trained in ascertaining those facts." In accordance with this idea, the author lays stress upon the more obvious features of the types considered, and seeks to lead the student to an intelligent appreciation of the significance of those features in studies under the title of 'Comparisons.' For example, a bony and a cartilaginous fish are studied separately, and then the facts acquired by the student are correlated by a series of questions which require a careful comparison. In this way twenty-five types are studied and compared, the types representing all the main divisions of the animal kingdom, and being chosen from the most readily accessible materials.

The text of the work is based upon the systematic relations and discusses the orders seriatim.

There is one detail of arrangement, however, which will not appear to everybody to be entirely happy. In the discussion of the fishes the Selachii and Teleosts are treated at some length, and then follows the part bearing upon Pisces. When one comes to the sub-classes he is referred back to Selachii and Teleosts. This may prove somewhat confusing, although the motive is evidently to emphasize the groups of which types have been studied.

There are numerous illustrations and diagrams, the latter in many cases being particularly suggestive.

The part devoted to the laboratory work is arranged in the form of simple directions for dissection and questions to lead the student to as independent a method as possible. The criticism that will be forthcoming will be that the laboratory work is meager—that students, even in the high school, frequently want to know more than the laboratory guide leads them to. This, however, is a minor criticism, since the teacher, if up to the mark, can supplement the work according to his judgment.

The introduction contains suggestions in regard to the carrying on of laboratory work; apparatus, which is reduced to a minimum as to both quantity and simplicity; materials for dissection, and reference books.

The whole is a small, handy volume, neatly bound and well printed on good paper.

F. E. LLOYD.

The Phytogeography of Nebraska. 1. General Survey, by ROSCOE POUND, PhD., Director of the Botanical Survey of Nebraska, and FREDERIC E. CLEMENTS, A.M., Assistant Instructor in Botany in the University of Nebraska. Lincoln, Neb. 1898. 8vo., 329 pp., with four maps. Presented by the authors to the Faculty of the University of Nebraska as a thesis for the degree of Doctor of Philosophy.

From the preface we learn that this work is the result of nearly five years of active study of the floral covering of Nebraska, carried on by the members of the Botanical Seminar in the Botanical Survey of the State. The systematic study of the vegetation of Nebraska was begun by Dr. Bessey in 1884, and has since been carried on by him and his students, all previous collecting having been more or less desultory and unreliable. The Botanical Survey was or-

ganized in 1892, and its work has been directed to the collecting of specimens and observations for a series of reports in which the floral covering of the State should be treated from the phytogeographical standpoint and for a series of monographs of the flora of Nebraska. A beginning has been made by the publication of three parts of the flora of the State, and the present work is the first part of the first series. The authors realize that so much yet remains to be done in many directions that a complete phytogeography of the State will be impossible for many years to come, but the work of the survey has progressed far enough to enable them to present the general facts of its phytogeography in an adequate manner and to deal with details in many of the more important subjects.

The writings of the German phytogeographers have been the chief source of inspiration, especially the Plant Geography of Germany, by Dr. Oscar Drude. It is only in recent years that this subject has become a distinct department of botanical knowledge, and with the exception of certain observations conducted by Professor MacMillan in Minnesota, this is the first attempt to conduct a botanical survey of any State in this manner. It is, therefore, of special interest and deserving of more than passing mention, as even a hasty review of the table of contents will be convincing proof of the broad scope of this work and shows the amount of preliminary preparation which it represents.

In the introduction the authors give a brief outline of the scope of their subject, and state that much of their terminology is new, having been translated from the German or newly coined to meet special necessities. The history of the botanical exploration of Nebraska is briefly given and a list of works consulted fills several pages, including many local lists and contributions to the State flora by Dr. Bessey and his students.

The subject is treated in five chapters, the first dealing with the physiography, geology and meteorology of the State. There is little rock exposed, the soil being of unusual depth, but in the southeastern part of the State the geological formations are Carboniferous, while the rest is Cretaceous and Tertiary. The climate is extremely hot in summer and mild in winter. Meteorological tables are given to show the temperature and rainfall for 1896.

The second chapter deals with statistics of regional limitations, showing that the four regions which occur in the State are the wooded bluff and meadow land region, the prairie region, the sand-hill region and the foot-hill region, and that of all these the proportions occurring in the State are only a small part of the same regions in adjacent States. Tables of species peculiar to each region are given. In the third chapter the different forms of vegetation are considered under the heading of woody plants and herbs, and the various habits and devices of each for protection and reproduction are considered in relation to their place of growth. Size, duration, means of reproduction and dissemination and protective devices are all important factors in the distribution of plants. According to the last report of the Botanical Survey there are 3,196 species in the flora of the State, of which 1,717 are cryptogams, the myxomycetes not being included. The number of trees is 58; shrubs, 33; bushes, 32; climbers, 13. A comparison of the flora of the State shows that 90 per cent. of the plants are herbaceous, there being but little forest. In New Jersey the percentage is 86, in Spain 83, and Germany 89. Herbs are less stable in their distribution than woody plants and their migrations are frequent. The herbacous plants are considered in groups as perennials, biennials, annuals, aquatics, parasites and thallophytes. Of the perennial herbs, those forming rosettes include 27 species, those forming mats 18, succulent plants adapted to high alpine or desert regions number 10 species; creepers and climbers include 35 species; turf-builders include 44 sod grasses and 49 bunch grasses; of plants with perennial rootstocks the number is 472, comprising the largest number of herbaceous plants, not including 37 bulbous or tuberous species and 16 ferns. Of biennial herbs the flora includes 59 species and annuals 197. Water plants are not as common, there being 12 floating plants, 31 submerged and 45 amphibious species in the State, and of parasitic species 14, exclusive of 3 species of saprophytes.

Of the Thallophytes the mosses are few, as only 50 species are known to occur in the State and 16 liverworts; lichens number 157. Of the Fungi, those growing on wood number 266, those on living plants 445, those on decaying matter 75, aquatic parasites on fishes, etc., 18, and on insects 9. The Algæ number 438. The chapter concludes with a discussion of the various biological characters, including protective devices, periods of flowering, seed production and dissemination.

The fourth chapter treats of the relations of the natural group of plants dividing them into six groups according to habitat, and giving tables for each of the natural families showing the numbers of species in each inhabiting the different regions. This represents an immense amount of local work, and it is impossible to give any adequate conception of the careful tabulation which it necessitates. The last chapter treats of the plant formations showing that the floral covering of the earth is not homogeneous, but presents great differences in the kinds and abundance of species as well as variations in the size, habit and habitat of individuals. Such diversities are the direct result of physical and climatic conditions peculiar to more or less restricted areas, hence the vegetation of the earth's surface is arranged into groups of definite constitution and more or less definite limits, known as plant formations. Such formations are invariably complex and more or less difficult to determine, yet they represent a biological community resulting from the forces induced by physiographical and meteorological phenomena, and may be defined as a piece of the floral covering, the extent of which is determined by a characteristic association of vegetable organism forming a stretch of land whose limits are biological and not physiographical, but often having the delimitation of some natural boundary. The topics are treated under the following heads: Forest, Meadow, Prairie, Sand hill, Foot hill, Salt marsh, Water plant, Culture and Waste formations. This chapter constitutes perhaps the most readable portion of the book, summing up the results and effects of all previous observations.

In the appendix certain corrections are made in elevations of various points, and the nomenclature is made to correspond with that of Britton and Brown's illustrated Flora. The four maps show the political boundaries of the State, its topographical characters, the river systems and the natural regions. The index is extensive, including both topics and species.

It will thus be seen that this work indicates the progress of biological studies in recent years, and the long distance from which it is removed from mere lists and catalogues, yet at the same time it emphasizes the importance of thorough systematic and morphological studies, and proves the necessity of broad and correct training in order to be able to accomplish such a task creditably. That this has been so ably done not only reflects credit on its authors, but also on the faculty under whose guidance the work has been accomplished.

ELIZABETH G. BRITTON.

SCIENTIFIC JOURNALS.

The American Naturalist for May opens with a paper on the origin of the mammalia by Professor Henry F. Osborn, presented first at the Toronto meeting of the British Association. The paper especially considers the evidence supporting the hypothesis that the mammals spring from the theriodont reptiles, knowledge of which has been so greatly increased by Professor Seelye's explorations in the Karoo beds of South Africa. The third chapter of the treatise, on the wings of insects, by Professor J. H. Comstock and Mr. J. G. Needham, treats of the Diptera. Mr. O. P. Hay writes on the classification of Amoid and Lepisosteoid fishes.

THE July number of *Appleton's Popular Science Monthly* opens with the first of a series of articles on the evolution of colonies, by Mr. James Collier. Mr. E. J. Prindle contributes an elaborately illustrated article on the methods used by the Weather Bureau in forecasting the weather. Professor S. W. Williston writes on saber-toothed cats. The frontispiece is a Portrait of Maria Agnesi, who was in 1750 nominated professor of mathematics in the University of Bologna.

THE *American Anthropologist* for June contains the following articles: An Ancient Human Effigy Vase from Arizona, by J. Walter

Fewkes; Use of Rubber Bags in Gauging Cranial Capacity, by Washington Matthews; Ojibwa Feather Symbolism, by W J McGee. The Girl and the Dogs—An Eskimo Folk-tale with Comments, by Signe Rink.

THE July *Monist* opens with an article by Professor C. Lloyd Morgan on 'The Philosophy of Evolution,' which seeks to reconcile metaphysics with science. Professor Jacques Loeb has a brief discussion of 'Assimilation and Heredity,' maintaining that, since any theory of heredity must be based upon the mechanics of assimilation, we are consequently forced to supplement our purely morphological hypothesis of heredity by a chemical theory. Dr. Paul Topinard devotes some forty odd pages to the treatment of the 'Social Problem,' which he reviews in the light of natural history, anthropology and sociology proper. In 'Gnosticism in Its Relation to Christianity,' Dr. Paul Carus seeks to show that gnosticism, far from having been a heretical Christian sect was a general religious movement of pre-Christian times, and that Christianity sprang from it and survived it by the law of the survival of the fittest.

SOCIETIES AND ACADEMIES.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, JUNE 21.

MR. LEWIS WOOLMAN described a series of well-borings from Rock Hall, Maryland, indicating the depth at which forty-one forms of diatoms occur. The deposit resembles that for 80 to 100 feet at Wildwood, Maryland. He regarded the deposit as much more recent than miocene. A small bed of the latter is placed between it and the Eocene. There is a considerable mixture of fresh-water diatoms with the marine forms.

MR. D. S. HOLMAN described the fission of three forms of infusorians generated in putrifactive solution.

MR. PHILIP P. CALVERT recounted his recent studies of dragon-flies from tropical America and dwelt on his mode of determining averages of variations in extensive groups. Much the largest proportion of such variation is atavistic, illustrations being given from the genera described.

A paper entitled 'A New Chipmunk from Northeastern China,' by Gerrit S. Miller, Jr,. was presented for publication.

EDW. J. NOLAN,
Recording Secretary.

TORREY BOTANICAL CLUB, APRIL 27, 1898.

THE first paper, by Mr. Tracy E. Hazen, was entitled 'Notes on the Life History of *Hæmatococcus* and other Fresh-water Algae.' He exhibited a dried specimen of *Hæmatococcus* from Vermont, consisting of a dull red incrustation on rock, from which some of his own cultures had been made. The paper, which will soon be published, described the stages of its life history, and was illustrated by colored drawings. Discussions by Professor Lloyd, Dr. Townsend, Dr. Britton and others followed. The Secretary referred to a gathering of Red Snow made at the Crimson Cliffs of North Greenland by the Peary party two years ago, which exhibits a much more brilliant red than the *Hæmatococcus* of our own neighborhood.

The second paper, by Mrs. Elizabeth G. Britton, was entitled 'An account of the Mosses collected by Mr. Pierre Jay in Peru and Bolivia in 1893.' She exhibited about 60 sheets of these mosses, the specimens shown forming, however, only a small part of the entire collection, which include many species of tropical American genera like *Hookeria* and *Meteorium*, not yet determined. The Bolivian specimens were collected in June and July near La Paz and Yungus, and are largely species of high altitudes and exposed localities. The Peruvian specimens were collected in the vicinity of Cuzco and the tributaries of the Madre de Dois, and and are mostly forest species, including showy *Phyllogoniums* and *Porotrichums* and various species of *Entodon* and *Rhizogonium*. The collection promises to be very interesting and will be compared with Dr. Rusby's collections of 1885 and M. Germain's, both of which have recently been enumerated and described by Dr. C. Müller in his Prodromus of the Mosses of Bolivia in the Nuovo Giornale Botanico Italiano for 1897.

EDWARD S. BURGESS,
Secretary.